10/544162
Rec'd PCT/PTO 29 JUL 2005
PCT/US2004/002225

Description

Toothless Crimping Tool For Plastic Pipe Connectors

Technical Field

The present invention relates to crimping tools generally and, more particularly, but not by way of limitation, to a novel crimping tool for plastic pipe connectors and method of use thereof, the tool having toothless jaws. Also provided is such a tool that can be used to gauge whether crimps have been properly made.

Background Art

The present invention is concerned with crimping, typically although not necessarily, copper alloy metallic rings around polyethylene plastic pipe to attach the pipe to metallic fittings. The fillings may be tee fittings or coupling fittings, for example. Such plastic pipe has become more and more used in construction, as it is relatively inexpensive and much more inexpensive to install.

A disadvantage of conventional crimping tools is that the jaws thereof are interlocking, with teeth at the top and bottom of one jaw in the opening defined by the jaws interfitting with complementarily shaped slots defined in the other jaw. As a consequence, the resulting marks and imperfections, or skiving and gouging of the crimped rings, caused by the interlocking teeth on the rings are unsightly.

Furthermore, because the presence of interlocking teeth requires that the opening defined by the jaws be located a relatively large distance from the pivot points of the jaws, in order to increase the required mechanical advantage, a relatively high force is required to crimp the rings. Also, the presence of the interlocking teeth does not allow a great degree of freedom in skew of the pipe being crimped and the toothed jaws are likely to cause skewed crimped rings.

Following crimping with a conventional tool, the degree of crimping of

a ring is determined by gauging with a separate tool to make sure that the crimping ring has been crimped to an ASTM-specified diameter. The separate tool is typically a flat piece of metal having outwardly open, semi-circular openings defined therethrough, one pair of openings being provided for each size crimp to be gauged. One of the openings is a NO GO opening, meaning that, if a crimped ring can be inserted into the NO GO opening, then that crimped ring does not meet ASTM specifications for crimping because the crimp is undersized. If the ring can be inserted in the other of the openings, which is a GO opening, then the ASTM specification for crimping has been met, provided that the ring cannot be inserted into the NO GO opening. If the ring cannot be inserted into the GO opening, then the crimped ring does not meet the ASTM requirements for crimping because the crimp is oversized. While the separate tool is satisfactory, it does require that the separate tool be kept in the vicinity of the work, and is subject to be lost or misplaced. The separate tool also requires that the crimping tool be removed from the work area or set aside while the crimping ring is gauged.

Accordingly, it is a principal object of the present invention to provide a crimping tool in which the jaws thereof are toothless.

It is a further object of the invention to provide such a tool in which the pivots pins of the jaws defining the opening can be located farther away from the distal ends of the jaws, thus increasing mechanical advantage.

It is an additional object of the invention to provide such a tool and method of use that require less crimping force.

It is another object of the invention to provide such a tool and method of use that are economical.

It is yet a further object of the invention to provide such a tool that can be used to gauge whether a crimping ring has been crimped sufficiently to meet required specifications.

Other objects of the present invention, as well as particular features, elements, and advantages thereof, will be elucidated in, or be apparent from, the

following description and the accompanying drawing figure.

Disclosure of Invention

The present invention achieves the above objects, among others, by providing, in a preferred embodiment, a crimping tool to crimp a cylindrical rings about cylindrical plastic pipe, comprising: first and second handles operative to open and close first and second jaws, respectively, pivotally attached, respectively, to proximal ends of said first and second handles and to each other; and said first and second jaws being toothless and defining therebetween, when said first and second jaws are closed, a cylindrical opening, said cylindrical opening to crimp said cylindrical ring about said cylindrical plastic pipe, and to produce a tight seal between said cylindrical plastic pipe and a cylindrical substrate over which said cylindrical plastic pipe is inserted. A method of using said crimping tool is provided, as is using said crimping tool as a crimping gauge.

Brief Description of Drawings

Understanding of the present invention and the various aspects thereof will be facilitated by reference to the accompanying drawing figures, provided for purposes of illustration only and not intended to define the scope of the invention, on which:

Figure 1 is a side elevational view of a crimping tool constructed according to the present invention.

Figure 2 is a side elevational view of a coupling fitting with which the present invention may be used.

Figure 3 is a side elevational view of an end of a length of plastic pipe.

Figure 4 is a side elevational view of a tee fitting with which the present invention may be used.

Figure 5 is a fragmentary, side elevational view of the tool in position to crimp a ring around an end of plastic pipe.

Figure 6 is a fragmentary, side elevational view of the tool crimping a ring around an end of plastic pipe.

Figure 7 is a fragmentary, side elevational view of another embodiment of a tool according to the present invention being used to gage the degree of crimping of a crimped ring.

Best Mode for Carrying Out the Invention

Reference should now be made to the drawing figures on which similar or identical elements are given consistent identifying numerals throughout the various figures thereof, and on which parenthetical references to figure numbers, when used, direct the reader to the view(s) on which the element(s) being described is (are) best seen, although the element(s) may be seen on other figures also.

Figure 1 illustrates a crimping tool, constructed according to the present invention, and generally indicated by the reference numeral 20. Crimping tool 20 includes first and second handles 30 and 32 pivotally connected by a pin 34. Pivotally connected, respectively, to handles 30 and 32 by pins 40 and 42 disposed at the proximal ends of the handles are first and second toothless jaws 44 and 46. First and second toothless jaws 44 and 46 are pivotally joined, respectively, by a link 50 extending between pins 52 and 54 disposed at approximately the midpoint of the jaws. A conventional ratchet mechanism 60 is disposed between handles 30 and 32. Since ratchet mechanism 60 is well known in the art, no further description thereof will be provided. A conventional adjustable linkage may also be provided in place of ratchet mechanism 60. When crimping tool 20 is in the closed position shown, first and second toothless jaws 44 and 46 define a substantially cylindrical opening 70.

Figure 2 illustrates a coupling fitting with which the crimping tool of the present invention may be used, the coupling being generally indicated by the reference numeral 100. Coupling fitting 100 includes two barbs 110 and 112 extending axially from a central portion 114.

Figure 3A illustrates the end of a length of plastic pipe 120.

Figure 3B illustrates a cylindrical copper alloy ring 130.

Figure 3C illustrates a tee fitting with which the crimping tool of the present invention may be used, the tee fitting being generally indicated by the reference numeral 140. Tee fitting 140 includes three barbs 142, 144, and 146 extending from a central portion 148, as shown.

Figure 4 illustrates plastic pipes 120 inserted over barbs 142 and 146, with crimping rings 130 disposed therearound. It will be understood that pipes 120 and rings 130 have been inserted over barbs 142 and 146 by being moved in the directions shown by the arrows on Figures 3A and 3B. The left side of Figure 4 shows crimping ring 130 uncrimped, while the right side of Figure 4 shows crimping ring 130 crimped. In the crimping process, the diameter of crimping ring 130 is decreased by about four to six percent and the length thereof is increased by about one and one-half to about five percent, to form a tight seal to be formed between plastic pipe 120 and barb 146. The width of first and second toothless jaws 44 and 46 is somewhat greater than the width of crimped crimping ring 130.

Figure 5 illustrates crimping ring 130 inserted over plastic pipe 120, the latter having been inserted over barb 146, with crimping tool 20 in an open position and having jaws 44 and 46 spread apart and in position to crimp the crimping ring around the plastic pipe.

Figure 6 illustrates that first and second toothless jaws 44 and 46 have been moved to their closed position, crimping ring 130 about plastic pipe 120. It will be noted from Figure 6 that smooth surfaces 160 and 162 and smooth surfaces 164 and 166, at the top and the bottom, respectively, of opening 70 (Figure 1) are in abutting relationship and that the opening defined by the jaws is substantially cylindrical. Smooth surfaces 160 and 162 and smooth surfaces 164 and 166 abut in a common plane. As with conventional crimping tools, crimping tool 20 first forms crimping ring into an oval shape and then into a circular shape. Unsightly marks and imperfections, or skiving and gouging, on

the outer periphery of crimping ring 130 are thus eliminated or minimized, resulting in a more professional appearance.

Although not apparent from inspection of Figures 5 and 6, pipe 120 can be skewed as much as 15 percent from the axis of opening 70 and tool 20 will compensate for this skew by straightening out the pipe and producing a tight seal, a feature not possible with conventional toothed jaws that tend to produce a skewed crimped crimping ring 130.

Comparing crimping tool 20 (Figure 1) with the conventional crimping tools shown in the Catalog Brochure titled SARGENT QUALITY TOOLS – PROFESSIONAL PLUMBING TOOLS, by Rostra Tool Company, Branford, Connecticut, it can be seen that opening 70 and pivot pins 52 and 54 are located substantially closer together on crimping tool 20 than are the like elements on the conventional crimping tools. For a ½' crimping tool 20, this distance is about 2.8-3.0 centimeters versus about 3.5 centimeters for a conventional crimping tool. This placement means that mechanical advantage can be increased with crimping tool 20 and the crimping force is reduced by about 15-20 percent. The crimping force, for example, required by a ½" tool constructed according to the present invention is about 60 to 70 pounds applied 1-3/4" from the distal ends of handles 30 and 32. The additional mechanical gain also leads to greater tool life and less field calibration.

Crimping tool 20 minimizes distortion of crimping rings 130 not crimping accurately 90° perpendicular to the pipe and fitting axes. Cold working of crimped rings 130 is achieved without the resistance in the tooth and valley areas of conventional toothed jaws. Because of the increased mechanical advantage, tool 20 can be made lighter than conventional toothed crimping tools and, therefore, user fatigue is minimized and productivity is improved.

Referring now to Figure 7, there is illustrated an alternative embodiment of crimping tool 20 (Figure 1), this embodiment indicated generally by the reference numeral 20'. Elements of crimping tool 20' having the same or similar functions as elements of crimping tool 20' are given primed reference

numerals. For a description of the functions of the foregoing elements of crimping tool 20', reference should be made to the previous drawing figures.

Crimping tool 20' includes a set screw 200 threadingly inserted through first toothless jaw 44', the distal end 202 of set screw 200 bearing against the inside surface of second toothless jaw 46' to limit the distance apart first and second toothless jaws 44' and 46' can be opened. Set screw 200 is thus used to adjust distance "A" between, respectively, smooth surfaces 160' and 162' of first and second toothless jaws 44' and 46' when the first and second toothless jaws are opened fully. This distance is set to the ASTM specification for crimped rings of the size for which crimping tool 20' is designed. Thus, crimping tool 20' can be used to pass over crimped crimping ring 130 to verify that the crimping ring has been crimped to the proper diameter. Thus, crimping tool 20' acts as a crimp gauge, eliminating inspection with an independent tool. Such would be difficult, if not impossible, with toothed jaws.

Reference first primarily to Figures 3A-3C, in use, crimping ring 130 is slid over plastic pipe 120. Then, plastic pipe 120 is pushed over barb 142 and the crimping ring 130 is positioned to approximately the middle of the barb. Then, crimping tool 20 (Figure 5) is opened and moved over crimping ring 130. Then, crimping tool 20 (Figure 6) is fully closed so that smooth surfaces 160 and 162 and smooth surfaces 164 and 166 are in abutting relationship. Then, crimping ring 130 is gauged to make sure that the crimping step has been done properly. If tool crimping 20' is employed, that tool itself is used to verify that the crimping step has been done properly.

Although various sizes of crimping tools 20 (Figure 1) and 20' (Figure 7) may be provided, the crimping tools may be sized to accommodate crimping rings 130 for pipe sizes 3/8", 1/2", 5/8", ¾", 1", and 1-1/4", for example.

In the embodiments of the present invention described above, it will be recognized that individual elements and/or features thereof are not necessarily limited to a particular embodiment but, where applicable, are interchangeable and can be used in any selected embodiment even though such may not be

specifically shown.

Spatially orienting terms such as "above", "below", "upper", "lower", "inner", "outer", "inwardly", "outwardly", "vertical", "horizontal", and the like, when used herein, refer to the positions of the respective elements shown on the accompanying drawing figures and the present invention is not necessarily limited to such positions.

It will thus be seen that the objects set forth above, among those elucidated in, or made apparent from, the preceding description, are efficiently attained and, since certain changes may be made in the above construction and method without departing from the scope of the invention, it is intended that all matter contained in the above description or shown on the accompanying drawing figures shall be interpreted as illustrative only and not in a limiting sense.

It is also to be understood that the following claims are intended to cover all of the generic and specific features of the invention herein described and all statements of the scope of the invention that, as a matter of language, might be said to fall therebetween.